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Ikebukuro

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(54) **GEAR MECHANISM FOR A FISHING REEL**

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(30) **Foreign Application Priority Data**

Oct. 11, 2016 (JP) JP2016-199773

(51) **Int. Cl.**

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A01K 89/00	(2006.01)
F16H 57/00	(2012.01)
F16F 15/121	(2006.01)
A01K 89/015	(2006.01)
A01K 89/01	(2006.01)

(52) **U.S. Cl.**

CPC ***A01K 89/006*** (2013.01); ***A01K 89/01*** (2013.01); ***A01K 89/015*** (2013.01); ***A01K 89/0186*** (2015.05); ***F16F 15/1215*** (2013.01); ***F16H 57/0006*** (2013.01); *A01K 89/01081* (2015.05)

(58) **Field of Classification Search**

CPC .. A01K 89/006; A01K 89/0186; A01K 89/01; A01K 89/015; A01K 89/01081; F16F 15/1215; F16F 57/0006

See application file for complete search history.

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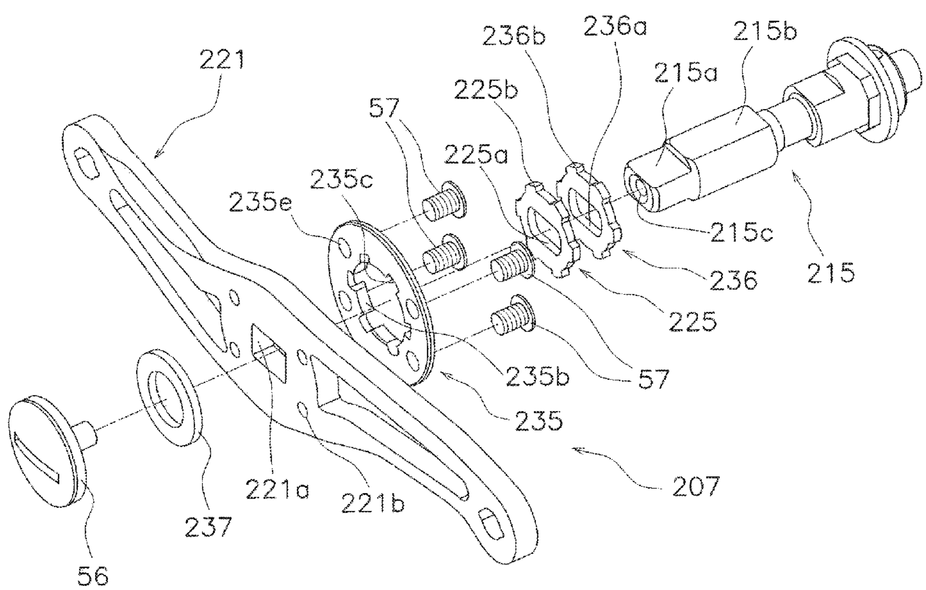
(57) **ABSTRACT**

A gear mechanism for a fishing reel includes a drive gear, a handle, and a vibration damper. The drive gear includes a gear having a prescribed gear diameter, and a drive gear shaft rotated together with the gear and having a smaller dimension than the prescribed gear diameter. The handle rotates the drive gear shaft. The vibration damper is disposed between the drive gear shaft and the handle, and dampens the transmission of the vibration of the drive gear.

7 Claims, 14 Drawing Sheets



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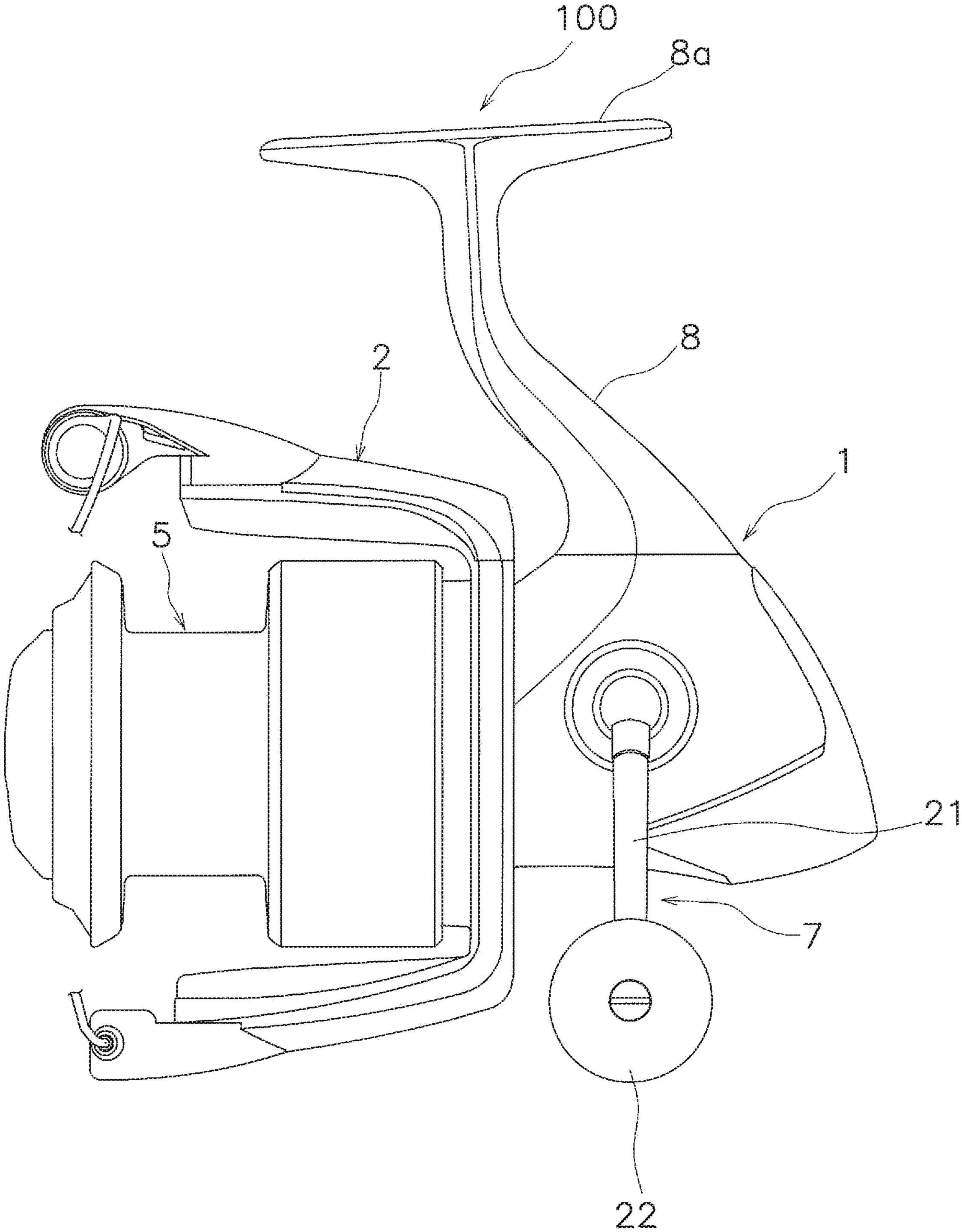


FIG. 1

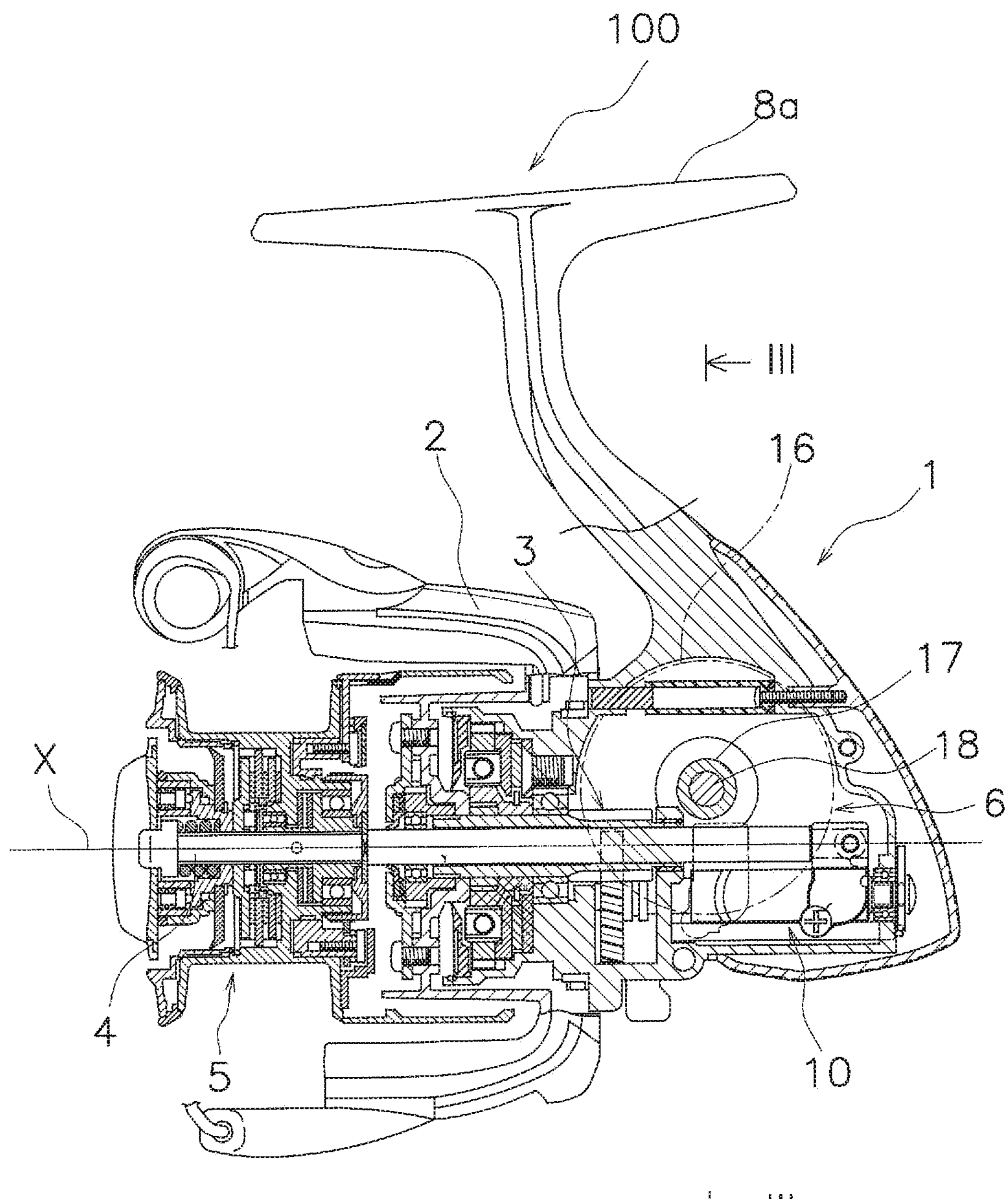
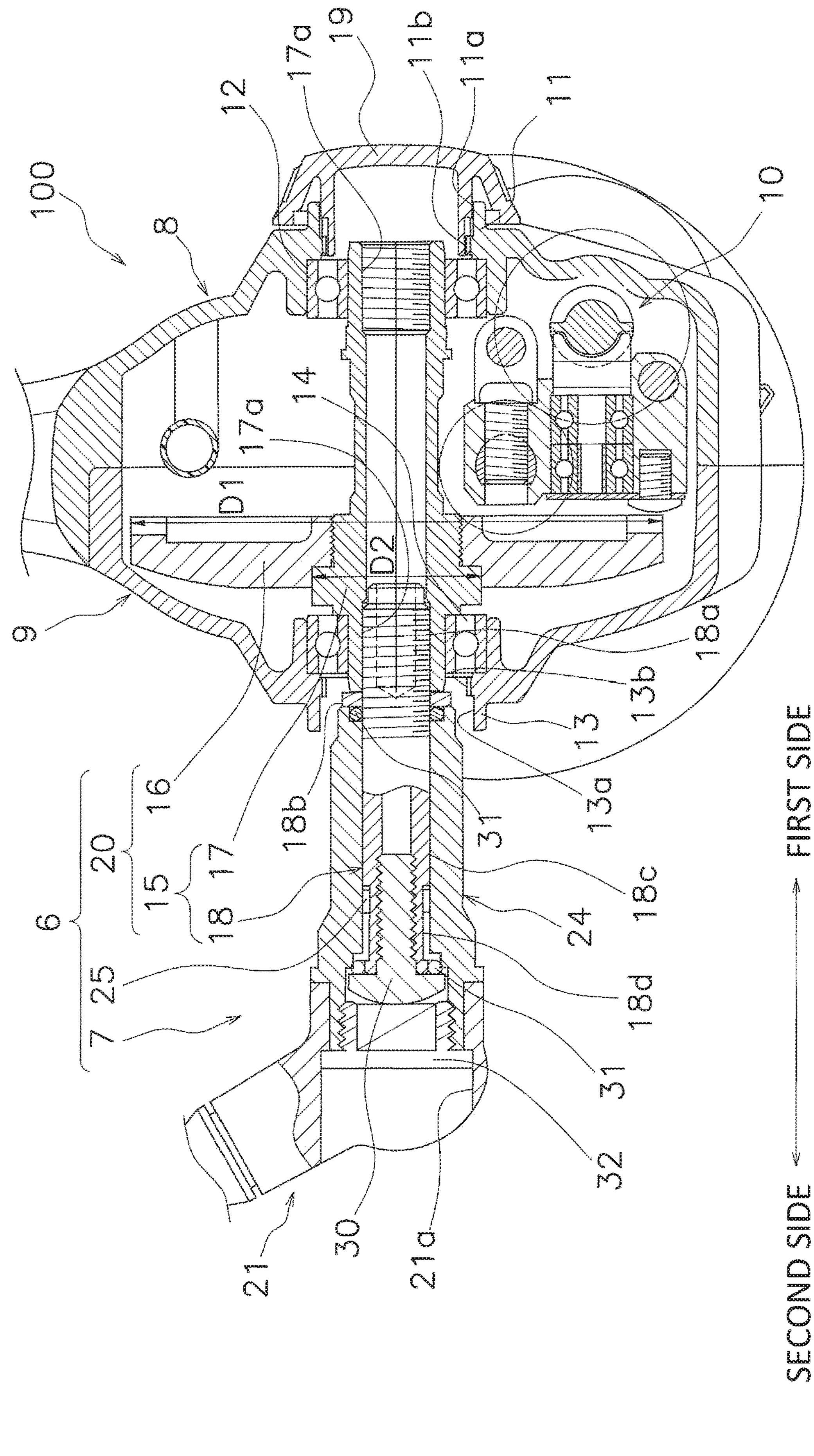


FIG. 2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11b
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11
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31
16
20
15
17
18b
6
18
18c
24
25
18d
7
31
32
21
30
21a
FIRST SIDE
SECOND SIDE

FIG. 3

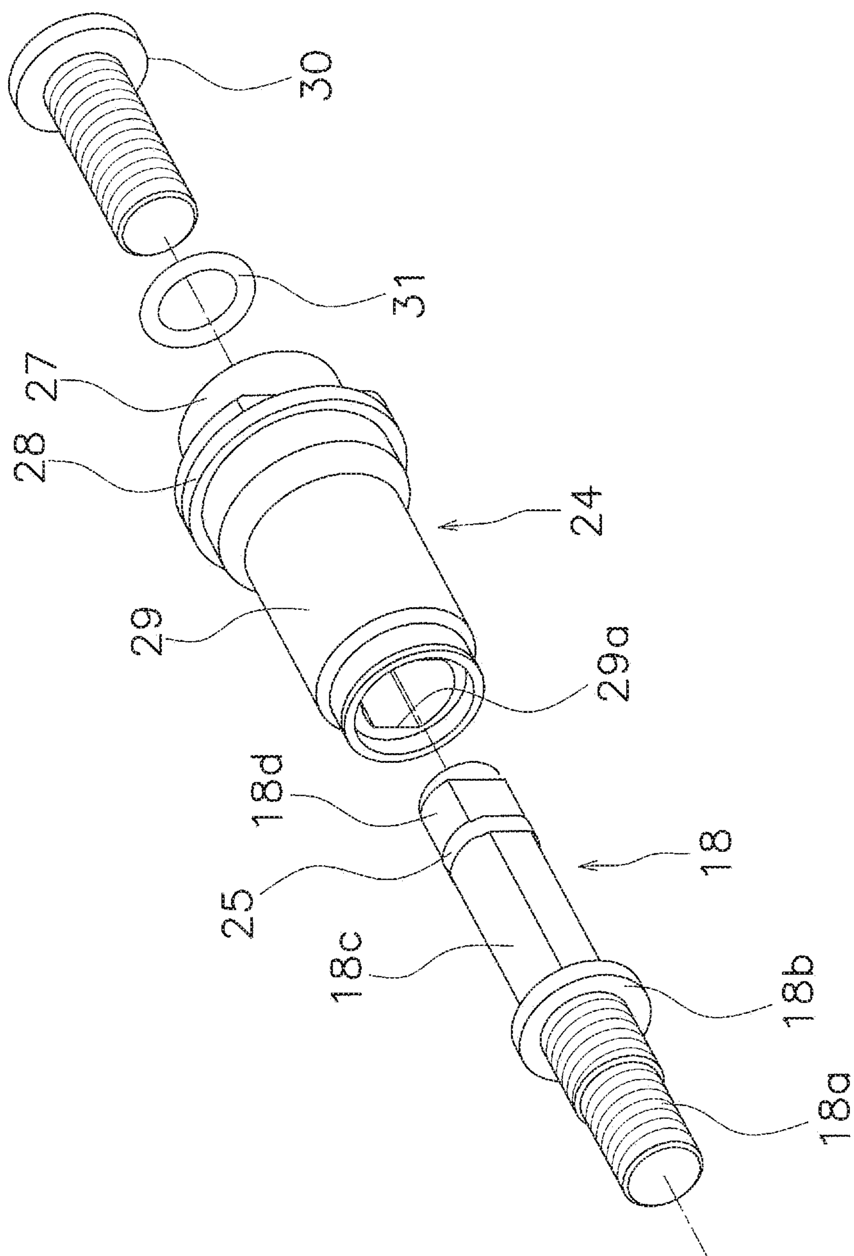
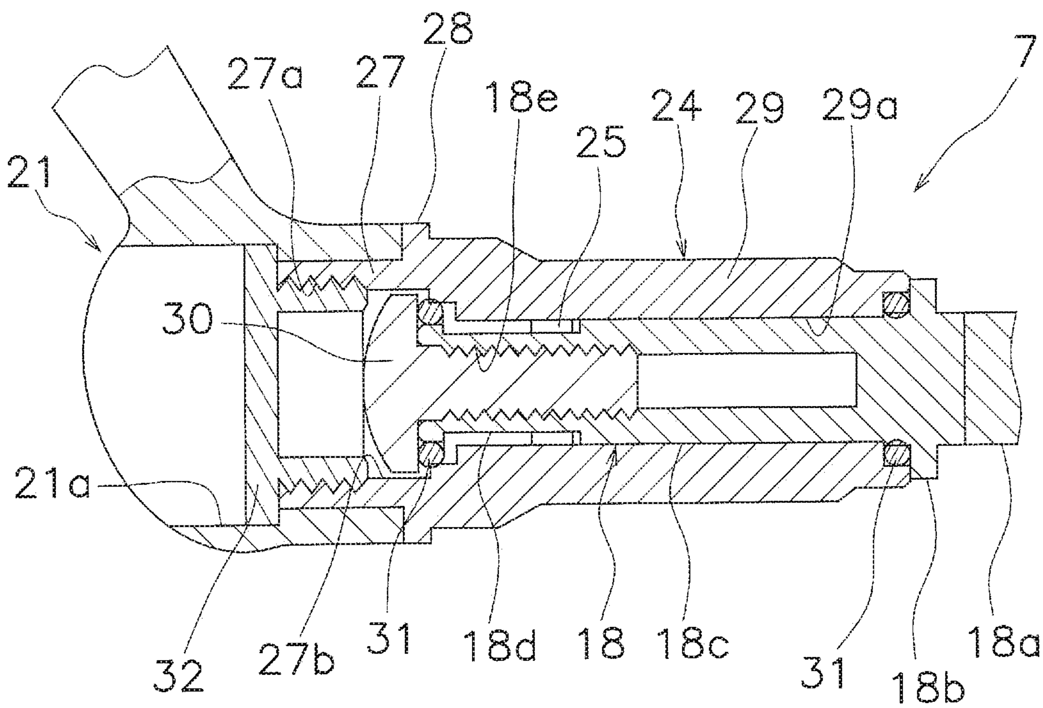


FIG. 4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7
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18e
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31
18b
18a

FIG. 5

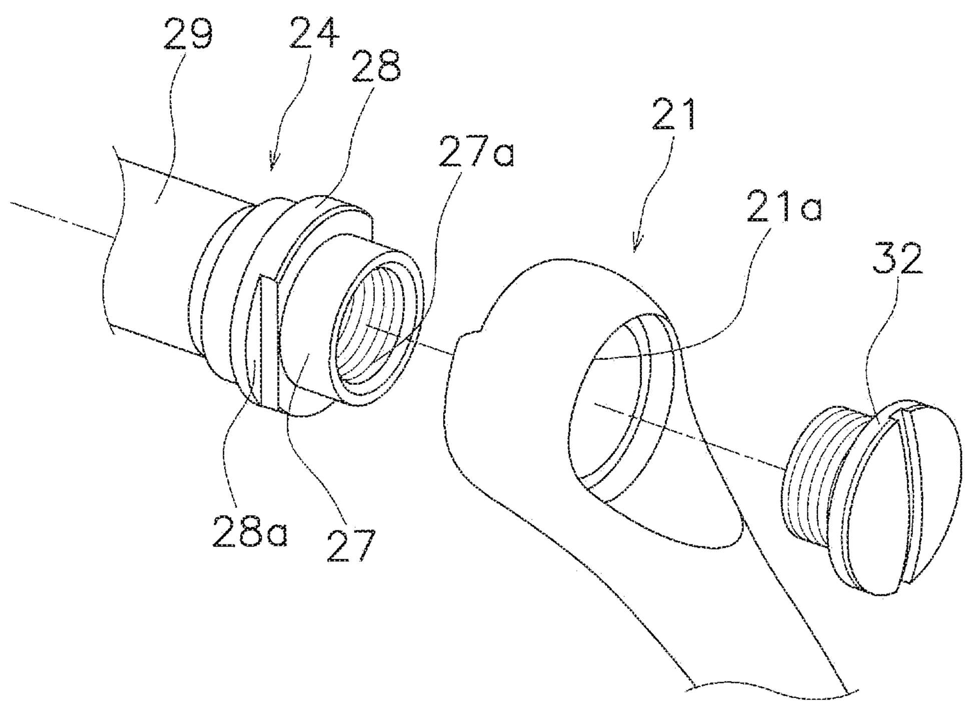
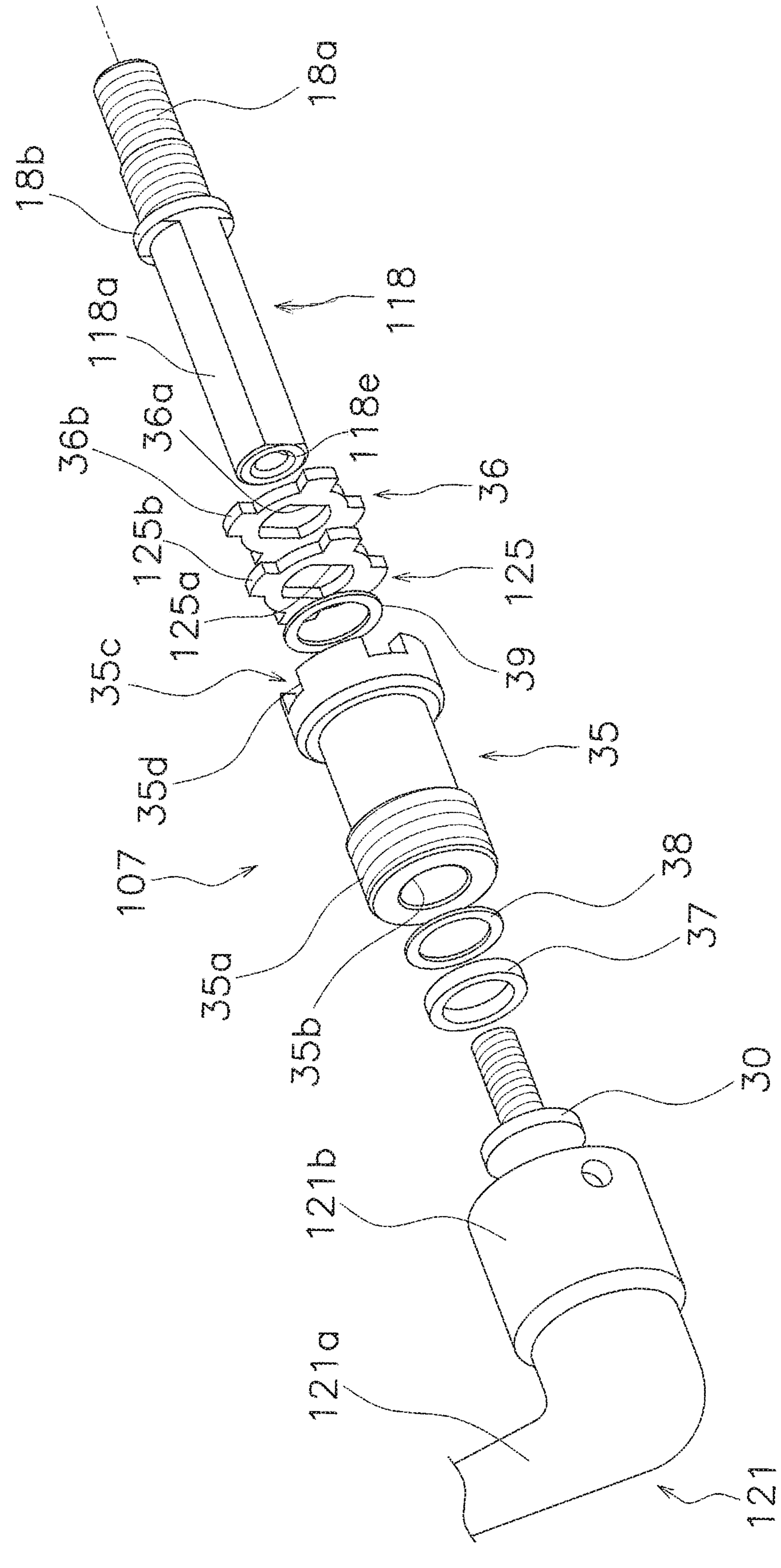


FIG. 6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35b
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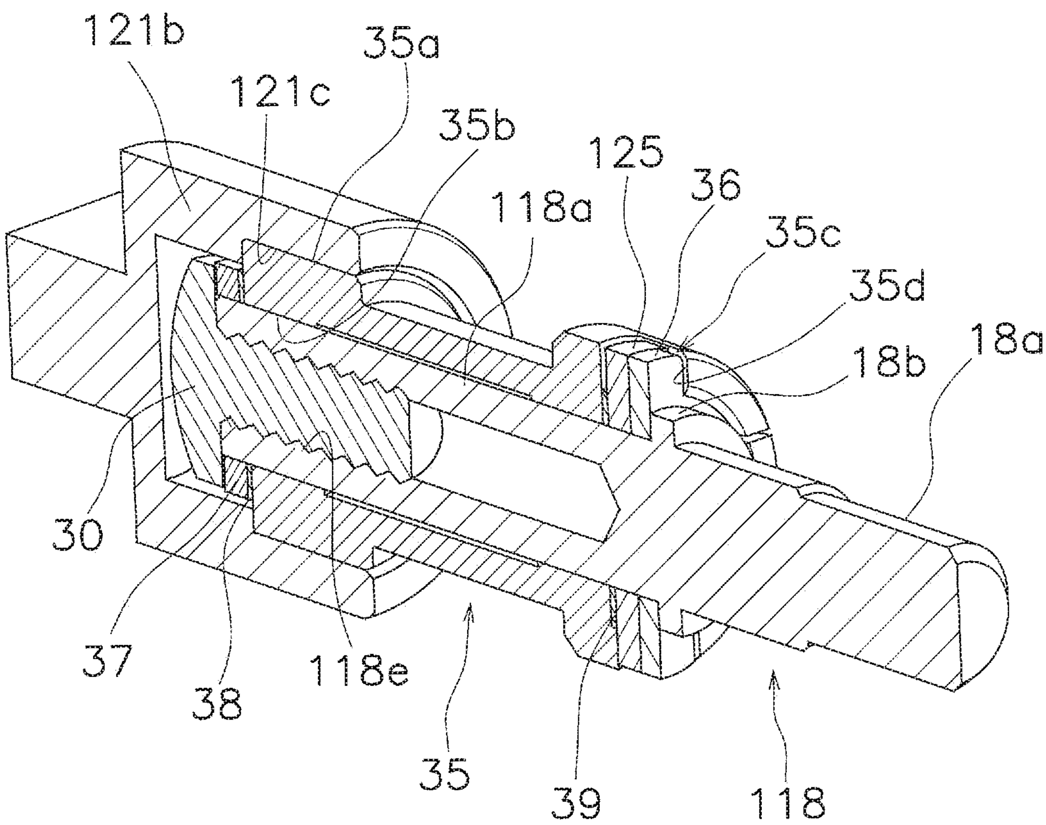
121b
121a
121

FIG. 7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39
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FIG. 8

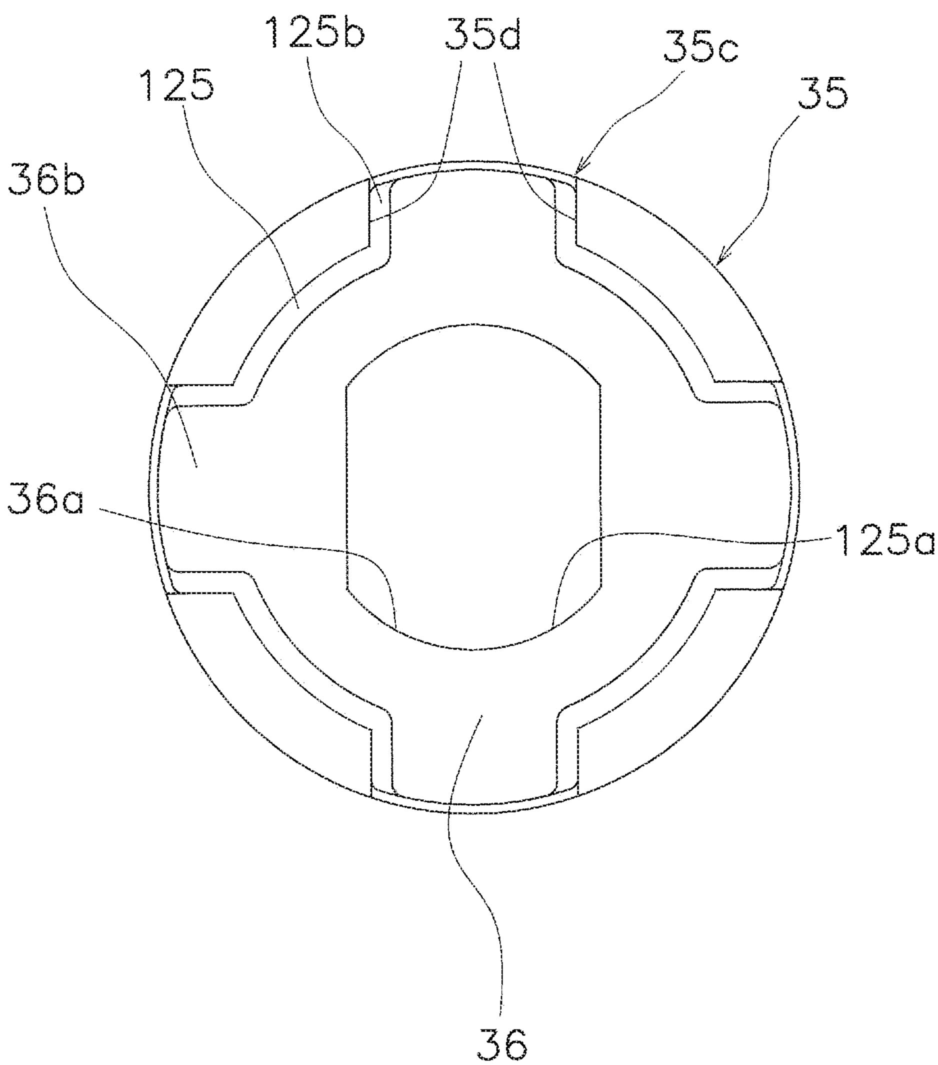


FIG. 9

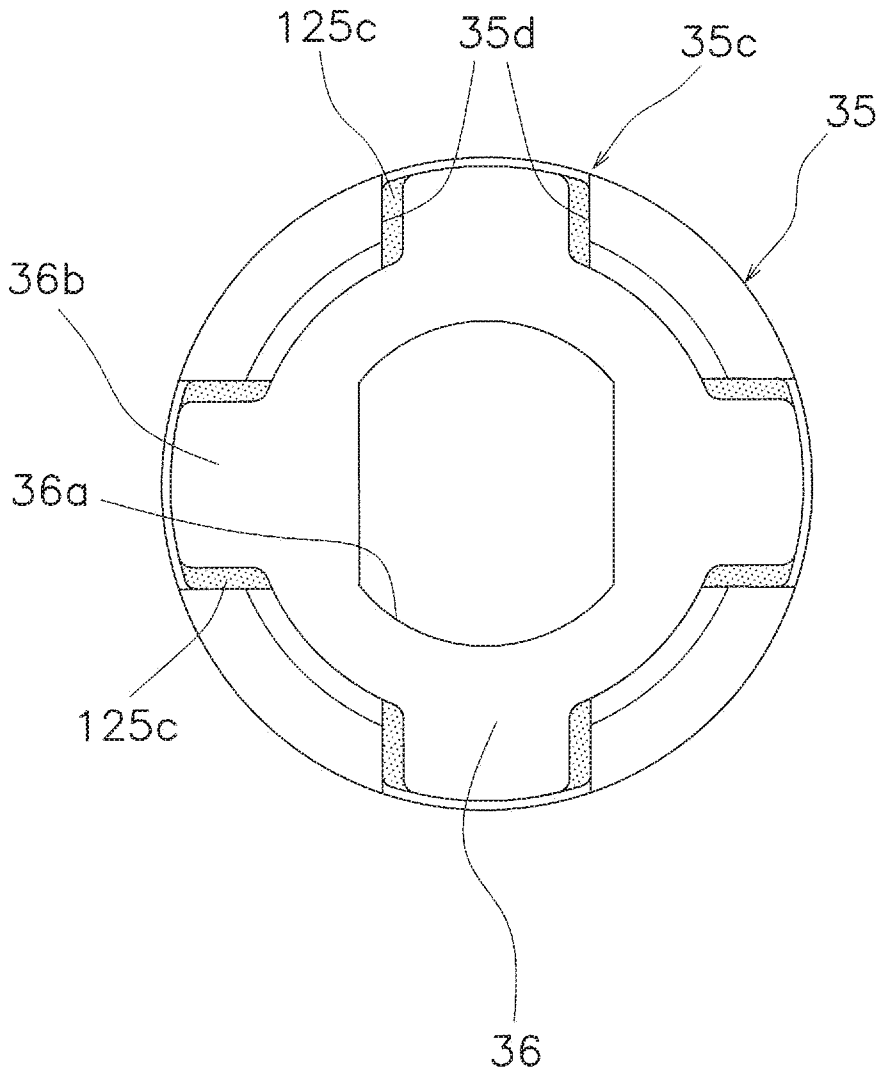


FIG. 10

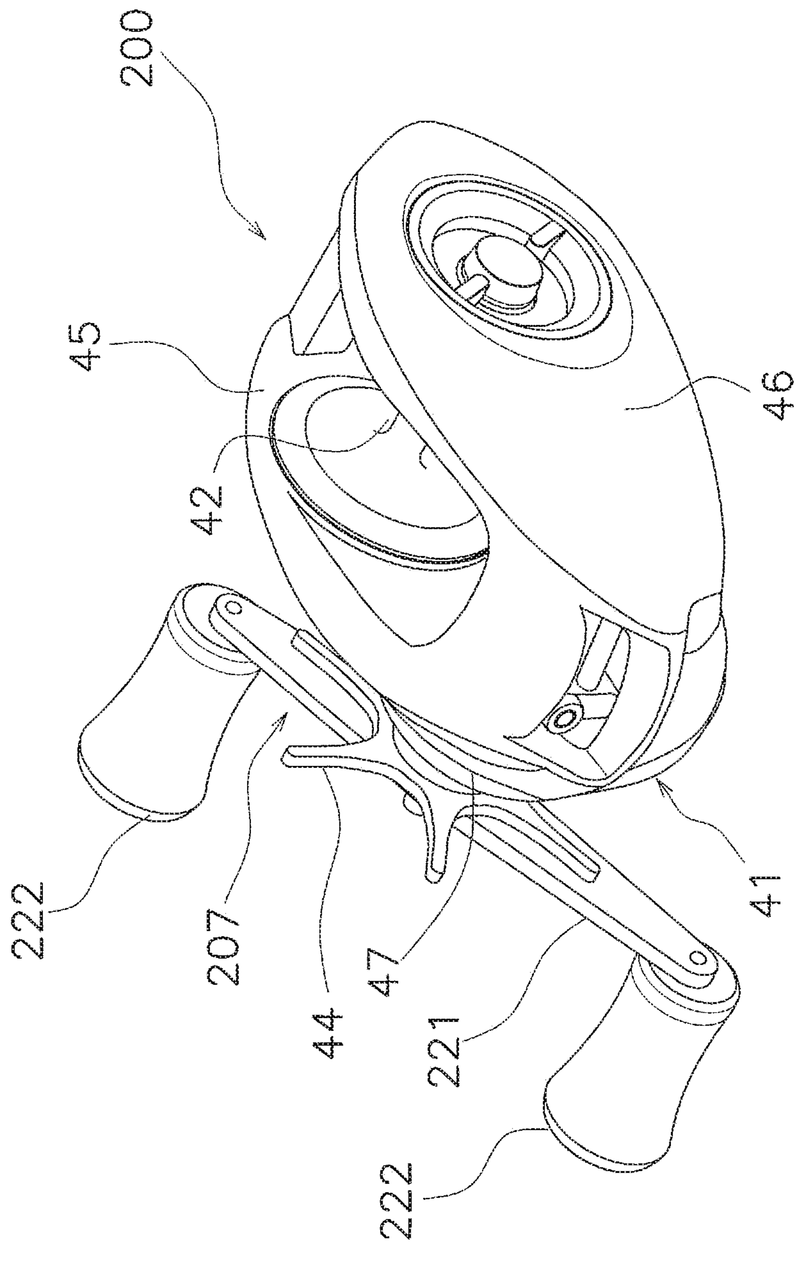
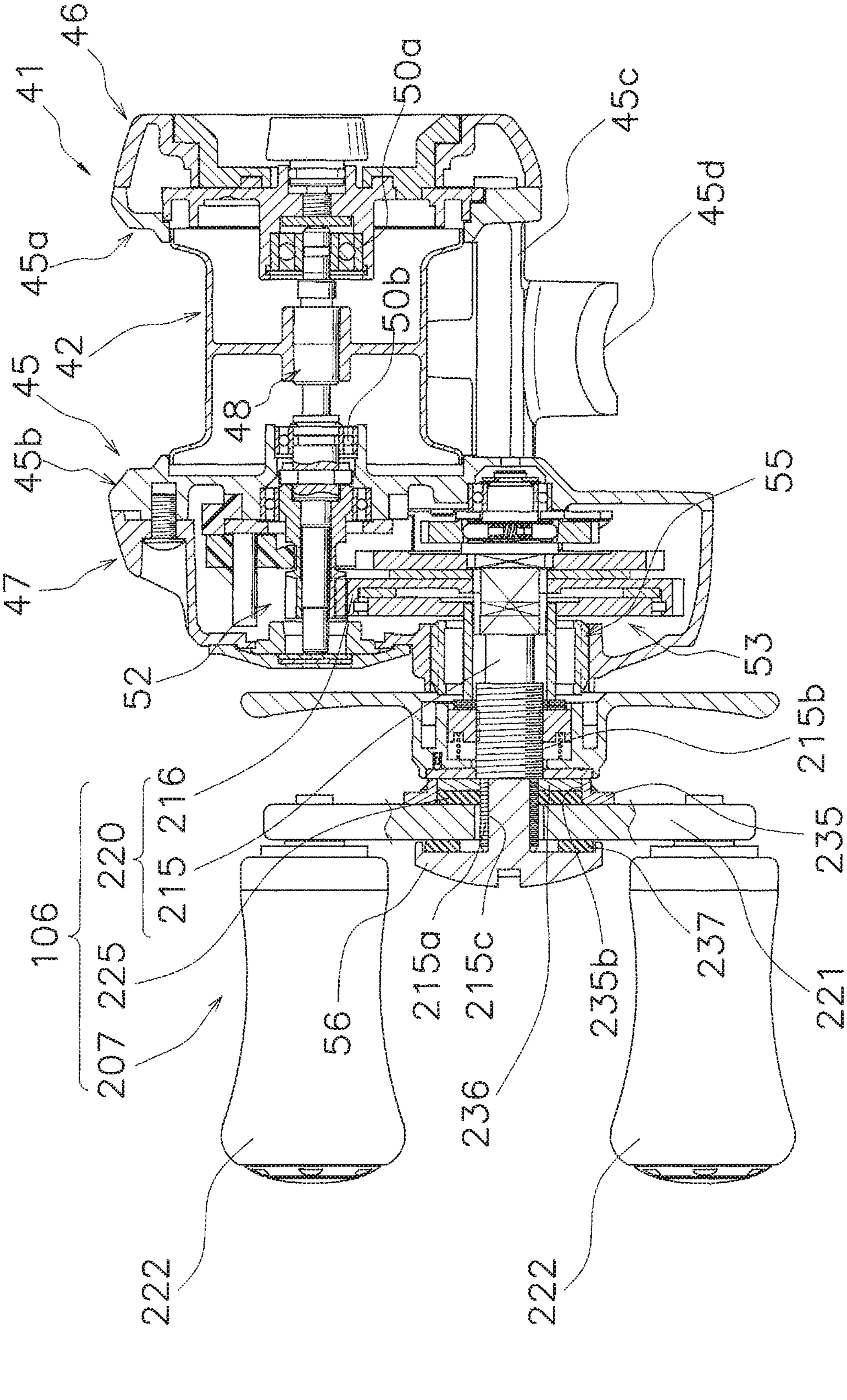


FIG. 11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215c
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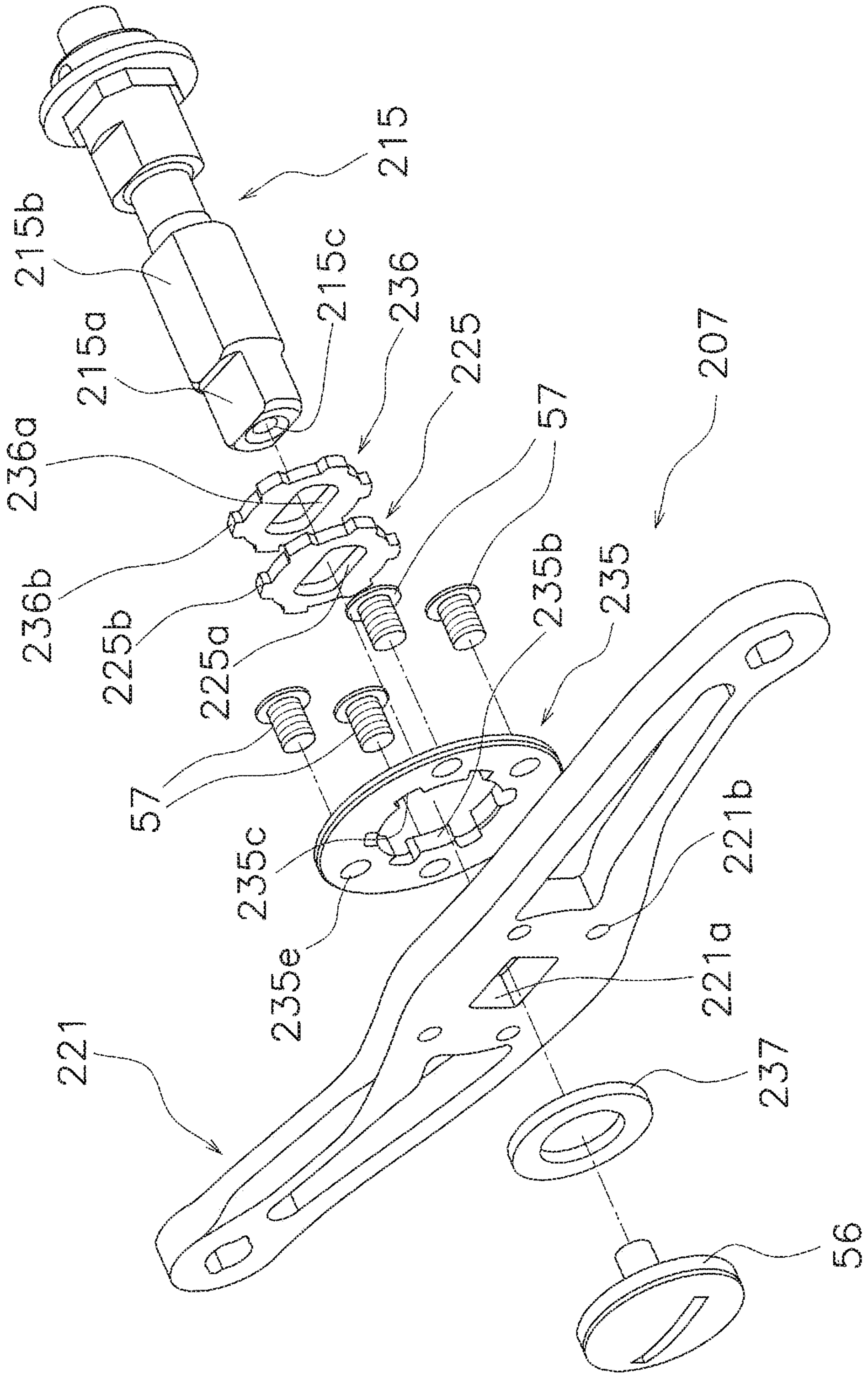
FIG. 12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235c
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221a
221
237
56

FIG. 13

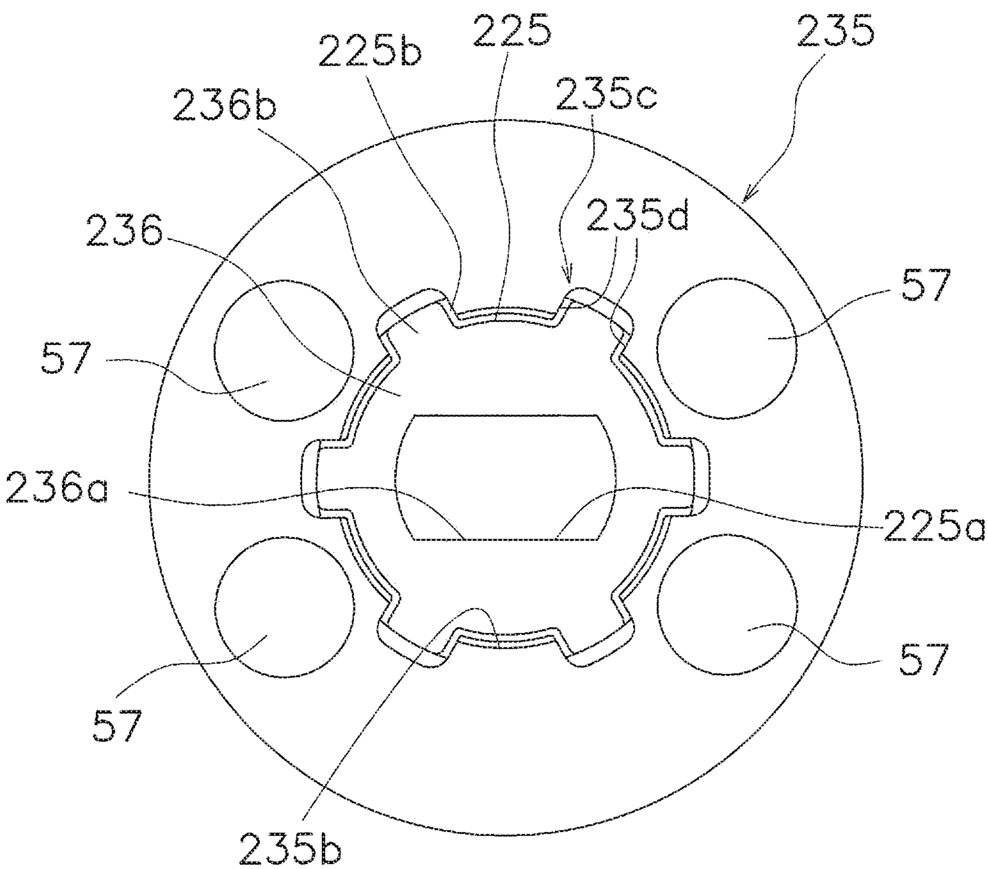

FIG. 14

GEAR MECHANISM FOR A FISHING REEL

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation application of U.S. patent application Ser. No. 15/646,547, filed on Jul. 11, 2017, which claims priority to Japanese Patent Application No. 2016-199773, filed on Oct. 11, 2016. The entire disclosures of U.S. patent application Ser. No. 15/646,547 and Japanese Patent Application No. 2016-199773 are hereby incorporated herein by reference.

BACKGROUND

Field of the Invention

The present invention relates to a gear mechanism for a fishing reel.

Description of the Related Art

In general, fishing reels include spinning reels, dual bearing reels, and the like. These reels comprise a handle assembly having a handle arm, and a gear mechanism that transmits the rotation of the handle arm to a spool. For example, in the spinning reel disclosed in Japanese Laid-Open Patent Publication No. 2004-24231, when a handle arm is rotated in a line-winding (reeling) direction, rotation is transmitted from the handle arm to the spool, via a handle shaft portion, a main gear shaft, a main gear, and a pinion gear.

In Japanese Laid-Open Patent Publication No. 2004-24231, a buffer member is disposed between the main gear shaft and the handle assembly. It is possible to suppress axial rattling between the main gear shaft and the handle shaft with the buffer member.

On the other hand, for example, when the handle arm is rotated in the line-winding (reeling) direction, vibration is generated by the meshing of the gears, such as the main gear and the pinion gear. In a conventional gear mechanism, this vibration due to the meshing of gears is transmitted to the handle arm, causing deterioration in the rotation feeling during rotation of the handle.

SUMMARY

Therefore, if the transmission of vibration due to meshing of gears to the handle arm can be dampened, it is possible to improve the rotation feeling.

The object of the present invention is to improve the rotation feeling by damping the vibration caused by the meshing of gears, which is transmitted to the handle arm, in a gear mechanism for a fishing reel.

The gear mechanism for a fishing reel according to one aspect of the present invention comprises a drive gear, a handle, and a vibration damper. The drive gear comprises a gear that has a prescribed gear diameter and a drive gear shaft that is rotated together with the gear and that has a smaller diameter than a prescribed gear diameter. The handle rotates the drive gear shaft. The vibration damper is disposed between the drive gear shaft and the handle, and dampens the transmission of the vibration of the drive gear.

In this gear mechanism for a fishing reel, it is possible to dampen the transmission of the vibration of the drive gear by the vibration damper disposed between the drive gear shaft and the handle. It is thereby possible to achieve an improvement in the rotation feeling.

Preferably, the vibration damper is elastically deformable, engages an engagement portion of a tubular member, and is made of an elastic material with a lower rigidity than the tubular member. In this embodiment, the vibration damper engages the engagement portion of the tubular member, and the rotation of the handle arm is transmitted to the drive gear shaft. Accordingly, the vibration due to the engagement of the gears is transmitted to the handle arm via the vibration damper, and the vibration is dampened by the vibration damper. It is thereby possible to achieve an improvement in the rotation feeling.

Preferably, the engagement portion of the tubular member engages the drive gear shaft after the vibration damper has been elastically deformed by a prescribed amount; this is an embodiment in which the rotational load is high and after the elastically deformable vibration damper has been elastically deformed by a prescribed amount, the handle shaft engages the engagement portion of the tubular member and rotation is transmitted; therefore, even if a high load is applied in the line-winding (reeling) direction, the rotation of the handle arm can be reliably transmitted to the drive gear shaft.

Preferably, the drive gear shaft has a large-dimension portion, and a small-dimension portion that is formed to have a smaller dimension than the dimension of the large-dimension portion. The large-dimension portion and the small-dimension portion are disposed in the inner peripheral portion of the tubular member. The vibration damper is disposed on the outer periphery of the small-dimension portion. The large-dimension portion engages the engagement portion of the tubular member after the elastic member has been elastically deformed by a prescribed amount. In this embodiment, the vibration damper and the drive gear shaft are capable of affecting rotation with a simple configuration.

Preferably, the tubular member is made of metal.

Preferably, the handle comprises a handle arm that extends in a direction that axially intersects the drive gear shaft, and a first transmitting member that is non-rotatably coupled to the handle arm and that has an engagement portion. In addition, the handle further comprises a second transmitting member that transmits the rotation of the handle to the drive gear shaft. The vibration damper is elastically deformable, engages the first transmitting member, and is made of elastic with a lower rigidity than the first transmitting member. The second transmitting member has a higher rigidity than the vibration damper and engages the engagement portion of the first transmitting member after the vibration damper has been elastically deformed by a prescribed amount to transmit the rotation of the handle to the drive gear shaft.

In this embodiment, the elastic member engages the engagement portion of the first transmitting member and the rotation of the handle arm is transmitted to the drive gear shaft until the elastically deformable vibration damper is elastically deformed by a prescribed amount. That is, if the rotational load is low, the rotational force is transmitted via the vibration damper. Accordingly, the vibration due to the engagement of gears is transmitted to the handle arm via the vibration damper, and the vibration is damped by the vibration damper. It is thereby possible to achieve an improvement in the rotation feeling.

On the other hand, if the rotational load is high, the second transmitting member engages the engagement portion of the first transmitting member to transmit the rotation after the vibration damper is elastically deformed by a prescribed amount; therefore, even if a high load is applied in the line-winding (reeling) direction, rotation of the handle arm can be reliably transmitted to the drive gear shaft.

Preferably, the engagement portion of the first transmitting member has at least one pawl receiving portion. The vibration damper comprises an elastic pawl that engages the at least one pawl receiving portion. The second transmitting member comprises a transmission pawl having a circumferential width that is narrower than the circumferential width of the elastic pawl of the vibration damper. The transmission pawl engages the pawl receiving portion after the elastic pawl of the vibration damper has been elastically deformed by a prescribed amount.

In this embodiment, the rotation is reliably transmitted by making the engagement portion a pawl receiving portion. In addition, by forming the width of the transmission pawl narrower than the width of the elastic pawl, the pawl receiving portion and the elastic pawl are engaged until the elastic pawl is elastically deformed by a prescribed amount, such that that the vibration due to the engagement of gears can be damped.

Preferably, the first transmitting member is metal with a plate shape, having a through-hole in the middle through which at least a portion of the drive gear shaft can be inserted. The engagement portion of the first transmitting member is recessed radially outwardly from the through-hole. In this embodiment, it is possible to realize the transmission of rotation via the vibration damper and the transmitting member with a simple configuration, even in a dual bearing reel.

Preferably, the first transmitting member is metal with a tubular shape, one end of which is non-rotatably coupled with the handle arm. The engagement portion of the first transmitting member is recessed axially from the end surface of the other end of the first transmitting member.

Preferably, the handle arm comprises a female threaded portion. The first transmitting member is fixed to the handle arm by a locking screw mounted in a locking hole formed on the radially outer side of the through-hole, being threaded into the female threaded portion. In this case, the first transmitting member and the handle arm can be reliably fixed.

Preferably, the handle comprises a handle arm that extends in a direction that axially intersects the drive gear shaft, a first transmitting member that is non-rotatably coupled to the handle arm and that has an engagement portion, and a second transmitting member that has an engaged portion to which rotational force is transmitted from the engagement portion of the first transmitting member. The vibration damper is disposed so as to be capable of abutting the engaged portion of the first transmitting member and the engaged portion of the second transmitting member, transmits the rotation of the first transmitting member to the second transmitting member, has a lower rigidity than the first and second transmitting members, and can be elastically deformed.

In this embodiment, the rotation of the handle arm is transmitted via the vibration damper. Accordingly, it is possible to dampen the vibration due to the engagement of gears when the handle arm is rotated in the line-winding (reeling) direction with the vibration damper. It is thereby possible to achieve an improvement in the rotation feeling.

According to the present invention, since the vibration due to the engagement of gears that is transmitted from the gears to the handle arm can be dampened, it is possible to achieve an improvement in the rotation feeling.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side view of the spinning reel according to a first embodiment.

FIG. **2** is a side cross-sectional view of the spinning reel according to the first embodiment.

FIG. **3** is a cross-sectional view taken along line III-III in FIG. **2**.

FIG. **4** is an exploded perspective view of a portion of the gear mechanism in the first embodiment.

FIG. **5** is a partial cross-sectional view of the gear mechanism of the first embodiment.

FIG. **6** is an exploded perspective view of a portion of the gear mechanism in the first embodiment.

FIG. **7** is a view corresponding to FIG. **4** showing a second embodiment.

FIG. **8** is a cross-sectional perspective view of a portion of FIG. **7**.

FIG. **9** is a view of a vibration damper and a second metal member disposed on the first metal member of the second embodiment.

FIG. **10** is a view corresponding to FIG. **9**, showing a modified example of the second embodiment.

FIG. **11** is a perspective view of the dual-bearing reel of a third embodiment.

FIG. **12** is a cross-sectional view of the dual-bearing reel of the third embodiment.

FIG. **13** is an exploded perspective view of a portion of the gear mechanism in the third embodiment.

FIG. **14** is a view of a vibration damper and a second metal member disposed on the first metal member of the third embodiment.

DETAILED DESCRIPTION OF THE INVENTION

First Embodiment

FIG. **1** and FIG. **2** show a side view and a cross-sectional view of a spinning reel **100** to which the first embodiment of the present invention is employed. In the following description, "front" indicates the direction in which the fishing line is unreeled; specifically, left in FIG. **1** and FIG. **2** is the "front."

The spinning reel **100** comprises a reel body **1**, a rotor **2**, a pinion gear **3**, a spool shaft **4**, a spool **5**, and a gear mechanism **6** having a drive shaft **17** and a handle shaft **18**.

As shown in FIG. **3**, the reel body **1** comprises a case part **8** and a lid body **9**. The lid body **9** is attached to the case part **8** using, for example, a bolt (not shown). The reel body **1** comprises an internal space that is defined by the case part **8** and the lid body **9**. A portion of the gear mechanism **6**, and an oscillating mechanism **10** for evenly winding a fishing line, are housed in the internal space.

The case part **8** comprises a mounting portion **8*a*** that extends in the longitudinal direction, as shown in FIG. **1**, and a tubular first boss portion **11**, as shown in FIG. **3**. The mounting portion **8*a*** is the portion that is attached to a fishing rod.

The first boss portion **11** is formed on a first side of the reel body **1** (refer to FIG. **3**). The first boss portion **11** comprises a first through-hole **11*a***. The first through-hole **11*a*** is a through-hole for passing a handle shaft **18** therethrough. A first female threaded portion **11*b***, in which is formed a female thread, is formed on the inner surface of the first through-hole **11*a***. A first axle bearing member **12** for supporting a first side of the driveshaft **17** is attached to the inner surface of the first boss portion **11**.

The lid body **9** comprises a tubular second boss portion **13**. The second boss portion **13** is formed on a second side of the reel body **1** (refer to FIG. **3**). The second boss portion **13** comprises a second through-hole **13***a*. The second through-hole **13***a* is a through-hole for passing a handle shaft **18** therethrough. A second female threaded portion **13***b*, in which is formed a female thread, is formed on the inner surface of the second through-hole **13***a*. A second axle bearing member **14** for supporting a second side of the driveshaft **17** is attached to the inner surface of the second boss portion **13**.

The rotor **2** is a member for winding a fishing line onto the spool **5**. As shown in FIG. **2**, the rotor **2** is fixed to the front portion of the pinion gear **3**, and is integrally rotated with the pinion gear **3**.

The pinion gear **3** is provided in the reel body **1**. In particular, the pinion gear **3** is formed in a tubular shape, and extends forward from the reel body **1**. The spool shaft **4** extends inside the pinion gear **3**. Meanwhile, the pinion gear **3** is supported in the reel body **1** via a plurality of axle bearing members (not shown).

The spool shaft **4** is disposed in the reel body **1**. In particular, the spool shaft **4** extends forward from inside the reel body **1**.

The spool **5** is a member onto which the fishing line is wound. The spool **5** is integrally reciprocated with the spool shaft **4** in the longitudinal direction.

As shown in FIG. **3**, the gear mechanism **6** comprises a drive gear **20**, a handle **7**, and a vibration damper **25**. The drive gear **20** comprises a drive gear shaft **15** and a gear **16** that has a prescribed gear diameter.

The drive gear shaft **15** comprises a driveshaft **17** and a handle shaft **18**.

The driveshaft **17** is a tubular shaft. Both ends of the driveshaft **17** are rotatably supported in the reel body **1** by first and second axle bearing members **12**, **14**. Further, a female threaded portion **17***a*, on the inner surface of which is formed a female thread, is formed at both ends of the driveshaft **17**. The driveshaft **17** is formed to have a smaller diameter than the gear diameter of the gear **16**.

The handle shaft **18** extends through the second through-hole **13***a*, and a portion thereof is disposed on the inner periphery of the driveshaft **17**. As shown in FIG. **3**, the dimension of the handle shaft **18** is smaller than the diameter of the gear **16**. A cap member **19**, which is threaded into the first female threaded portion **11***b*, is attached to cover the first through-hole **11***a*, through which the handle shaft **18** does not extend. Meanwhile, a cap member **19** can also be threaded into the second female threaded portion **13***b* of the second through-hole **13***a*. Conversely to FIG. **3**, if the handle shaft **18** is disposed on the first side, the cap member **19** is attached to the second through-hole **13***a*.

As shown in FIG. **4** and FIG. **5**, a male threaded portion **18***a*, an annular shaft flange portion **18***b*, a large-dimension portion **18***c*, and a small-dimension portion **18***d* are formed on the handle shaft **18** from the inner end (the end positioned inside the reel body **1**) toward the outer end (the end positioned outside the reel body **1**).

The male threaded portion **18***a* is formed at the inner end portion of the handle shaft **18**, and a male thread is formed on the outer perimeter thereof. This male threaded portion **18***a* and the female threaded portion **17***a* formed on the inner periphery of the drive shaft **17** are threaded together. The handle shaft **18** is thereby threaded and fixed to the drive shaft **17**, and is integrally rotated with the drive shaft **17**.

The small-dimension portion **18***d* has a smaller dimension than the dimension of the large-dimension portion **18***c*. The cross-sectional shape of the large-dimension portion **18***c* and the small-dimension portion **18***d* is an oval shape. Further, the handle shaft **18** has a screw hole **18***e* that extends through the inside of the small-dimension portion **18***d* from the outer end of the handle shaft **18**.

As shown in FIG. **3**, the gear **16** is coupled to the driveshaft **17**, and is integrally rotated with the driveshaft **17**. The gear **16** is a face gear, and meshes with the pinion gear **3**. The handle shaft **18**, the driveshaft **17**, and the gear **16** are rotated, and the pinion gear **3** is also rotated, by rotating the handle **7** that is attached to the reel body **1**. Accompanying the rotation of the pinion gear **3**, the oscillating mechanism **10** reciprocates the spool shaft **4** in the longitudinal direction.

As shown in FIG. **3** and FIG. **5**, the handle **7** is mounted to the handle shaft **18**. The handle **7** comprises a handle arm **21**, a handle grip **22** that is mounted to the distal end of the handle arm **21** (refer to FIG. **1**), and a tubular member **24**.

The handle arm **21** extends in a direction that axially intersects the drive gear shaft **15**. The handle arm **21** comprises a through-hole **21***a* that extends through in the axial direction, on the proximal end side, which is the side that is attached to the handle shaft **18** (more accurately, to the tubular member **24** described later). A portion of the distal end surface of the inner end of the through-hole **21***a* is formed in an oval shape.

As shown in FIG. **4**, FIG. **5**, and FIG. **6**, the tubular member **24** comprises, in order from the outer end, a boss portion **27**, a flange portion **28**, and an engagement portion **29**. The large-dimension portion **18***c* and the small-dimension portion **18***d* of the handle shaft **18** are disposed on the inside of the tubular member **24**. The tubular member **24** can be member made of, for example, metal.

The boss portion **27** is formed on the outer end portion of the tubular member **24**, and a female threaded portion **27***a* is disposed on the distal end inner surface thereof. As shown in FIG. **5**, a large-diameter hole portion **27***b* is formed further inside the female threaded portion **27***a*. The large-diameter hole portion **27***b* has substantially the same diameter as the internal diameter of the female threaded portion **27***a*, and is formed larger than the internal diameter of the internal engagement portion **29**.

The flange portion **28** is formed to have a larger outer diameter than the outer diameter of the boss portion **27**. As shown in FIG. **6**, the flange portion **28** is formed such that a portion of the flange portion **28** on the boss portion **27** side has an oval shape, and has a locking surface **28***a*. The through-hole **21***a* of the handle arm **21** is fitted to the outer periphery of the boss portion **27** and the locking surface **28***a*. Then, the screw member **32**, which is inserted from the outer side of the through-hole **21***a* of the handle arm **21** is threaded into the female threaded portion **27***a* of the boss portion **27**. The tubular member **24** is thereby non-rotatably coupled with the handle arm **21**. Meanwhile, when connecting the tubular member **24** and the handle arm **21**, for example, a resin sheet (not shown) for suppressing rattling may be interposed between the tubular member **24** and the handle arm **21**.

The engagement portion **29** comprises an oval-shaped engagement hole **29***a* in the inner portion. The shape of the engagement hole **29***a* is substantially the same as the large-dimension portion **18***c* of the handle shaft **18**. In particular, the engagement hole **29***a* has a prescribed gap from the handle shaft in the rotational direction. The large-dimension portion **18***c* of the handle shaft **18** is thereby able to engage the engagement hole **29***a*.

As shown in FIG. **5**, a bolt **30** is housed in the tubular member **24**, from the central portion to the outer end portion of the tubular member **24** in the longitudinal direction. The bolt **30** is threaded into a screw hole **18***e* of the handle shaft **18**, which is inserted in the inner portion of the tubular member **24**, and the head portion thereof is housed in the large-diameter hole portion **27***b*. The end surface of the tubular member **24** on the inner end side abuts the shaft flange portion **18***b* of the handle shaft **18**, and the tubular member **24** is fixed to the handle shaft **18**, by threading the bolt **30** into the screw hole **18***e* of the handle shaft **18**. Meanwhile, seal members **31** are disposed between the head of the bolt **30** and the bottom surface of the large-diameter hole portion **27***b*, and between the outer peripheral surface of the large-dimension portion **18***c* of the handle shaft **18** and the inner surface of the distal end of the tubular member **24**. The seal members **31** prevent seawater, etc., from intruding into the tubular member **24**, and to suppress axial rattling of the handle part **7**.

As shown in FIG. **4** and FIG. **5**, the vibration damper **25** is formed in an annular shape, and mounted on the outer periphery of the small-dimension portion **18***d* of the handle shaft **18**. The vibration damper **25** is made of resin, for example, and is an elastically deformable elastic member with a lower rigidity than the tubular member **24**.

Rotation Transmission Path

In the first embodiment, the vibration damper **25** engages the tubular member **24** and the rotation of the handle arm **21** is transmitted to the handle shaft **18**, until the vibration damper **25** is elastically deformed by a prescribed amount. In particular, the vibration damper **25** engages the engagement hole **29***a* formed on the inner surface of the tubular member **24**.

That is, when the line-winding force (rotational force) by the handle arm **21** is small, the rotational force is transmitted along the following transmission path to rotate the rotor **2**: handle arm **21**→tubular member **24** (engagement hole **29***a* of the engagement portion **29**)→vibration damper **25**→handle shaft **18**→drive shaft **17**→gear **16**→pinion gear **3**. Here, since the rotational force of the handle arm **21** is transmitted to the drive gear shaft **15** via the vibration damper **25**, the vibration due to the engagement of gears is damped and transmitted to the handle arm **21**. It is thereby possible to improve the rotation feeling when an angler rotates the handle part **7** in the line winding direction.

Meanwhile, as shown in FIG. **3**, the vibration damper **25** preferably includes a dimension D**2** (here, the dimension of the drive shaft **17** and the handle shaft **18**) of the transmission path that is smaller in diameter than the diameter D**1** (here, the diameter of the gear **16**) of the gear in which vibration due to the engagement of gears is generated. Further, a greater effect can be expected if the dimension D**2** (here, the dimension of the drive shaft **17** and the handle shaft **18**) of the small-dimension transmission path to which the vibration damper **25** is provided is smaller than the diameter D**1** (here, the diameter of the gear **16**) of the gear in which vibration due to the engagement of gears is generated.

After the vibration damper **25** is elastically deformed by a prescribed amount, the handle shaft **18** engages the tubular member **24** and the rotation of the handle arm **21** is transmitted to the handle shaft **18**. In particular, when the vibration damper **25** is elastically deformed by a prescribed amount (to a degree at which the gap between the engagement hole **29***a* of the tubular member **24** and the large-diameter portion **18***c* of the handle shaft **18** is eliminated), the large-dimension portion **18***c* and the engagement hole **29***a* come into contact, and the rotation is directly transmitted from the tubular member **24** to the handle shaft **18**.

That is, in the case of a high load with a large line-winding force by the handle arm **21**, as described above, the vibration damper **25** is elastically deformed, and the rotational force is transmitted along the following transmission path to rotate the rotor **2**: handle arm **21**→tubular member **24** (engagement hole **29***a*)→handle shaft **18** (large-dimension portion **18***c*)→drive shaft **17**→gear **16**→pinion gear **3**. Here, since the rotational force of the handle arm **21** is directly transmitted to the drive gear shaft **15** without interposing the vibration damper **25**, it is possible to quickly and reliably transmit the rotational force.

In this manner, for example, when the load in the rotational direction to wind the fishing line is small, it is possible to transmit the rotation to the drive gear shaft **15** while dampening the vibration of the gear that is transmitted to the handle arm **21**, by interposing the vibration damper **25**. Further, when a high load is applied, it is possible to reliably transmit the rotation of the handle arm **21** to the drive gear shaft **15**, by directly transmitting the rotation from the tubular member **24** to the drive gear shaft **15**. Meanwhile, the amount by which the vibration damper **25** can be elastically deformed, is set to greater than or equal to an amount that corresponds to the gap between the engagement portion **29** and the large-dimension portion **18***c*.

Second Embodiment

FIG. **7** and FIG. **8** are an exploded perspective view and a cross-sectional perspective view of a portion of the gear mechanism **106** in which the second embodiment of the present invention is employed. The overall configuration of the spinning reel in the second embodiment is the same as the spinning reel **100** of the first embodiment, and thus, the description thereof is omitted here. In the second embodiment, only a portion of the handle shaft **118**, a portion of the handle **107**, and the configuration of the vibration damper **125**, are different from the configuration of the first embodiment. Accordingly, configurations that are different from the first embodiment will be described below. Meanwhile, the configurations that are the same as the first embodiment are given the same reference symbols.

The handle shaft **118** of the second embodiment comprises a shaft portion **118***a*, in addition to the same male threaded portion **18***a* and shaft flange portion **18***b* as in the first embodiment. The shaft portion **118***a* extends from the shaft flange portion **18***b* to the distal end of the handle shaft **118** on the outer end. The outer dimensions of the shaft portion **118***a* are uniformly formed. A screw hole **118***e* that extends axially from the distal end surface of the shaft portion **118***a* is formed in the center of the shaft portion **118***a*. The cross-sectional shape of the shaft portion **118***a* is non-circular, and is formed in an oval shape, in the same manner as in the first embodiment.

The handle **107** is disposed on the outer end of the handle shaft **118**. The handle **107** comprises a handle arm **121**, a handle grip **22** that is mounted on the distal end of the handle arm **121** (refer to FIG. **1**), a first metal member **35** (one example of the first transmitting member), and a second metal member **36** (one example of the second transmitting member).

The handle arm **121** comprises an arm portion **121***a*, and a boss portion **121***b* that is integrally rotated with the arm portion **121***a*. The arm portion **121***a* extends from the boss portion **121***b* in a direction that intersects the handle shaft **118**. As shown in FIG. **8**, a female threaded portion **121***c*, on the inner surface of which is formed a female thread, is formed on the inner periphery of the boss portion **121***b*. The outer end portion of the handle shaft **118** is housed in the boss portion **121***b*.

The first metal member **35** has a tubular shape, and the outer end portion thereof is non-rotatably coupled with the boss portion **121***b* of the handle arm **121**. In particular, a male threaded portion **35***a*, on the outer peripheral surface of which is formed a male thread, is formed in the outer end portion of the first metal member **35**, and this male threaded portion **35***a* is threaded into the female threaded portion **121***c*, which is formed in the inner periphery of the boss portion **121***b* of the handle arm **121**.

The first metal member **35** comprises a through-hole **35***b* and a plurality of pawl receiving portions **35***c*. The shaft portion **118***a* of the handle shaft **118** is inserted into the through-hole **35***b*.

Each of the plurality of pawl receiving portions **35***c* is axially recessed from an end surface of the first metal member **35**, on the side into which the handle shaft **118** is inserted (inner end side). A pair of side walls **35***d* are thereby formed in the pawl receiving portion **35***c*.

Here, a bolt **30** is threaded into the screw hole **118***e* of the shaft portion **118***a* of the handle shaft **118** (refer to FIG. **8**). Then, an end surface of the bolt **30** abuts the outer end surface of the shaft portion **118***a* via a buffer member **37** and a washer **38**. In this manner, by threading the bolt **30** into screw hole **118***e* of the handle shaft **118**, and abutting the head portion of the bolt **30** to the end surface of the shaft portion **118***a* via the buffer member **37**, etc., the inner end surface of the first metal member **35** abuts the shaft flange portion **18***b* of the handle shaft **118** via a washer **39**, the vibration damper **125** and the second metal member **36**. The first metal member **35** is thereby fixed to the handle shaft **118**. Meanwhile, the buffer member **37** functions to dampen the vibration in the axial direction, as well as to prevent the loosening of the bolt **30**.

The second metal member **36** is formed in a plate shape, and comprises a through-hole **36***a* and a plurality of metal pawls (one example of a transmission pawl) **36***b*. The through-hole **36***a* is a non-circular hole that engages the shaft portion **118***a* of the handle shaft **118**. The second metal member **36** is thereby non-rotatably attached to the handle shaft **118**. The second metal member **36** is configured to have a higher rigidity than the vibration damper **125**. Meanwhile, the second metal member **36** is sandwiched between the pawl receiving portion **35***c* of the first metal member **35** and the shaft flange portion **18***b* of the handle shaft **118**, such that the movement thereof in the axial direction is restricted.

Each of the plurality of metal pawls **36***b* extends radially outwardly from the through-hole **36***a*. The metal pawls **36***b* are disposed so as to be capable of engaging at least one of the pair of side walls **35***d* of the pawl receiving portion **35***c*, when the handle arm **121** is rotated in the line winding direction. In particular, as shown in FIG. **9**, the metal pawls **36***b* are formed such that the circumferential widths are narrower than those of the elastic pawl **125***b*. Accordingly, the metal pawls **36***b* are disposed so as to not abut the pair of side walls **35***d* when the handle arm **121** is not rotating.

As shown in FIG. **7** and FIG. **9**, the vibration damper **125** is formed in a plate shape, and comprises a through-hole **125***a* and a plurality of elastic pawls **125***b*. The vibration damper **125** is made of resin, for example, and is an elastically deformable elastic member with a lower rigidity than the first metal member **35**. The through-hole **125***a* is a non-circular hole that engages the shaft portion **118***a* of the handle shaft **118**. The vibration damper **125** is thereby non-rotatable relative to the handle shaft **118**.

Each of the plurality of elastic pawls **125***b* extends radially outwardly from the through-hole **125***a*. The elastic pawls **125***b* engage the pawl receiving portions **35***c* of the first metal member **35**. In particular, the elastic pawls **125***b* of the vibration damper **125** are disposed abutting the pair of side walls **35***d* of the pawl receiving portions **35***c*. Meanwhile, as shown in FIG. **8**, the vibration damper **125** is sandwiched between the pawl receiving portions **35***c* and the shaft flange portion **18***b* of the handle shaft **118**, such that the movement thereof in the axial direction is restricted.

Rotation Transmission Path

In the second embodiment, the vibration damper **125** engages the pawl receiving portions **35***c* of the first metal member **35**, and the rotation of the handle arm **121** is transmitted to the handle shaft **118**, until the vibration damper **125** is elastically deformed by a prescribed amount. In particular, the elastic pawls **125***b* of the vibration damper **125** engage the side walls **35***d* of the pawl receiving portions **35***c* of the first metal member **35**, and the rotation of the handle arm **121** is transmitted to the handle shaft **118**.

That is, when the line-winding force (rotational force) by the handle arm **121** is small, the rotational force is transmitted along the following transmission path to rotate the rotor **2**: handle arm **121**→first metal member **35** (pawl portions **35***c*)→vibration damper **125** (elastic pawls **125***b*) →handle shaft **118**→drive shaft **17**→gear **16**→pinion gear **3**. Here, since the rotational force of the handle arm **121** is transmitted to the drive gear shaft **15** via the vibration damper **125**, the vibration due to the engagement of gears is dampened and transmitted to the handle arm **121**. It is thereby possible to improve the rotation feeling when an angler rotates the handle part **107** in the line winding direction.

Then, after the vibration damper **125** is elastically deformed by a prescribed amount, the second metal member **36** engages the first metal member **35** and the rotation of the handle arm **121** is transmitted to the handle shaft **118**. In particular, when the elastic pawls **125***b* of the vibration damper **125** are elastically deformed by a prescribed amount, the metal pawls **36***b* with a narrower circumferential width than the elastic pawls **125***b* engage the pawl receiving portions **35***c* of the first metal member **35**.

That is, in the case of a high load with a large line winding force by the handle arm **121**, as described above, the vibration damper **125** is elastically deformed, and the rotational force is transmitted along the following transmission path to rotate the rotor **2**: handle arm **121**→first metal member **35** (pawl portions **35***c*)→second metal member **36** (metal pawls **36***b*)→handle shaft **118**→drive shaft **17**→gear **16**→pinion gear **3**. Here, since the rotational force of the handle arm **121** is directly transmitted to the drive gear shaft **15** without interposing the vibration damper **125**, it is possible to quickly and reliably transmit the rotational force.

As described above, in the second embodiment as well, for example, when the load in the rotational direction to wind the fishing line is small, the rotation of the handle arm **121** is transmitted to the drive gear shaft **15** via the vibration damper **125**, and rotation is transmitted via the second metal member **36** when a high load is applied; therefore, the same effects as in the first embodiment can be obtained. Further, in the same manner as the first embodiment, since the vibration damper **125** is disposed in a transmission path (here, the diameter of the first metal member **35** (pawl receiving portion **35***c*), the second metal member **36** (metal pawl **36***b*), and the handle shaft **118**) with a smaller dimension than the diameter (here, the diameter of the gear **16**) of the gear in which vibration due to the engagement of gears is generated, it is possible to effectively damp the vibration.

Modified Example of the Second Embodiment

In a modified example of the second embodiment, only the configuration of the vibration damper **125** of the second embodiment is changed. Here, as shown in FIG. **10**, the vibration damper **125***c* is fixed to both side surfaces of the metal pawl **36***b* of the second metal member **36**. That is, the vibration damper **125***c* is disposed so as to fill the gaps in the pawl receiving portions **35***c* of the first metal member **35** and the metal pawl **36***b* of the second metal member **36**. The rotation of the handle arm **121** can thereby be transmitted to the handle shaft **118** by the presence of the metal pawl **36***b*, even when a load is applied in a rotational direction for winding the fishing line and the vibration damper **125***c* is elastically deformed.

Meanwhile, in the modified example of the second embodiment, since the vibration damper **125***c* is disposed between the portion where the pawl receiving portion **35***c* engages the metal pawl **36***b*, the pawl receiving portion **35***c* and the metal pawl **36***b* will not come in contact and engage even when the vibration damper **125***c* is elastically deformed. Accordingly, unlike the second embodiment, the rotation of the first metal member **35** is always transmitted to the second metal member **36** via the vibration damper **125***c*, even when the vibration damper **125***c* is elastically deformed by a prescribed amount.

Third Embodiment

As shown in FIG. **11** and FIG. **12**, the dual-bearing reel **200**, which employs the third embodiment of the present invention, comprises a reel body **41**, a spool **42**, and a gear mechanism **106**.

The reel body **41** comprises a frame **45**, a first side cover **46** and second side cover **47** that are mounted so as to cover the two sides of the frame **45**, and a front cover (not shown) that is mounted to the front of the frame **45**.

As shown in FIG. **12**, the frame **45** comprises a first side plate **45***a* and a second side plate **45***b* that are arranged so as to face each other across a prescribed interval, a plurality of connecting portions **45***c* that connect the first side plate **45***a* and the second side plate **45***b*, and a mounting portion **45***d* that is mounted to the fishing rod.

As shown in FIG. **12**, the spool **42** is disposed between the first side plate **45***a* and the second side plate **45***b*. A fishing line is wound on the outer perimeter surface of the spool **42**. The spool **42** is fixed to a spool shaft **48** that extends through the center of the spool **42**, and is integrally rotated with the spool shaft **48**. The two ends of the spool shaft **48** are rotatably supported with respect to the reel body **41** by axle bearing members **50***a*, **50***b*.

As shown in FIG. **12**, the gear mechanism **206** comprises a drive gear **220**, a pinion gear **52**, a drag mechanism **53**, a handle **207**, and a vibration damper **225**.

The drive gear **220** comprises a drive gear shaft **215** and a gear **216** that has a prescribed gear diameter.

As shown in FIG. **13**, the drive gear shaft **215** comprises a first shaft portion **215***a*, a second shaft portion **215***b*, and a screw hole **215***c*. The drive gear shaft **215** can have a smaller dimension than the diameter of the gear **216**. Meanwhile, the drive gear shaft **215** is prevented from rotating in the line delivering direction (casting direction) by a one-way clutch **55** (refer to FIG. **12**) that is disposed on the outer perimeter of the drive gear shaft **215**.

The first shaft portion **215***a* is formed on the outer portion of the drive gear shaft **215**. The second shaft portion **215***b* extends from the first shaft portion **215***a* to the inner end, and can have larger dimensions than the dimensions of the first shaft portion **215***a*. The cross-sectional shape of the first shaft portion **215***a* and the second shaft portion **215***b* is non-circular, and is an oval shape here. The screw hole **215***c* extends from an end surface of the first shaft portion **215***a* through the inside of the first shaft portion **215***a*.

The gear **216** is attached to the drive gear shaft **215**. The gear **216** is rotated together with the drive gear shaft **215**. The pinion gear **52** meshes with the gear **216**. The drag mechanism **53** brakes the rotation of the spool **42** in the line-delivering direction. Here, a detailed description of the drag mechanism **53** is omitted.

The handle **207** is attached to the first shaft portion **215***a* of the drive gear shaft **215**. The handle **207** comprises a handle arm **221**, handle grips **222** that are mounted on the ends of the handle arm **221**, a first metal member **235** (one example of the first transmitting member), and a second metal member **236** (one example of the second transmitting member).

The handle arm **221** extends in a direction that axially intersects the drive gear shaft **215**. As shown in FIG. **13**, the handle arm **221** comprises a through-hole **221***a* that extends through the center in the axial direction. A plurality of female threaded portions **221***b* that extend through in the axial direction are formed around the periphery of the through-hole **221***a*. Female threads are formed on the inner surface of the female threaded portions **221***b*.

As shown in FIG. **13**, the first metal member **235** has a plate shape, and comprises a through-hole **235***b*, a plurality of pawl receiving portions **235***c*, and a plurality of locking holes **235***e*.

The first shaft portion **215***a* of the drive gear shaft **215** extends through the through-hole **235***b*. Here, a bolt **56** extends through the through-hole **221***a* of the handle arm **221** from the outer end side of the handle arm **221**, and is threaded into the screw hole **215***c* of the first shaft portion **215***a* (refer to FIG. **12**). Then, an end surface of the bolt **56** abuts the outer surface of the handle arm **221** via a buffer member **237**. In this manner, by threading the bolt **56** into screw hole **215***c* of the drive gear shaft **215**, and abutting the head portion of the bolt **56** to the outer surface of the handle arm **221** via the buffer member **237**, the inner side surface of the handle arm **221** abuts the outer end surface of the second shaft portion **215***b* of the drive gear shaft **215** via the vibration damper **225** and the second metal member **236**. The handle arm **221** is thereby attached to the drive gear shaft **215**. The buffer member **237** damps the vibration in the axial direction, as well as prevents loosening of the bolt **56**.

Each of the plurality of pawl receiving portions **235***c* is recessed radially outwardly from the through-hole **235***b*. As shown in FIG. **14**, a pair of side walls **235***d* are thereby formed in each pawl receiving portion **235***c*.

Each of the plurality of locking holes **235***e* is formed radially outwardly of the pawl receiving portion **235***c*. Screws **57** extend through locking holes **235***e* from the reel body **41** side of the first metal member **235**, and are threaded into the female threaded portion **221***b* of the handle arm **221**. The first metal member **235** is thereby non-rotatably coupled with the handle arm **221**.

The second metal member **236** is formed in a plate shape, and comprises a through-hole **236***a* and a plurality of metal pawls (one example of a transmission pawl) **236**_b_. The through-hole **236**_a_ is a non-circular hole that is engaged by the first shaft portion **218**_a_. The second metal member **236** is thereby non-rotatably attached to the drive gear shaft **215**. The second metal member **236** can have a higher rigidity than the vibration damper **225**.

Each of the plurality of metal pawls **236**_b_ extends radially outwardly from the through-hole **236**_a_. The metal pawls **236**_b_ are disposed so as to be capable of engaging at least one of the pair of side walls **235**_d_ of the pawl receiving portions **235**_c_, when the handle arm **221** is rotated in the line-winding direction. In particular, as shown in FIG. **14**, the metal pawls **236**_b_ are formed such that the circumferential widths are narrower than those of the elastic pawls **225**_b_ described later. Accordingly, the metal pawls **236**_b_ are disposed so as to not abut with the pair of side walls **235**_d_, in a state in which the handle arm **221** is not being rotated.

The vibration damper **225** is formed in a plate shape, and comprises a through-hole **225**_a_ and a plurality of elastic pawls **225**_b_. The vibration damper **225** can be made of resin, for example, and is an elastically deformable elastic member with a lower rigidity than the first metal member **235**.

The through-hole **225**_a_ is a non-circular hole that engages with the first shaft portion **218**_a_. The vibration damper **225** is thereby non-rotatable with respect to the handle shaft **218**.

Each of the plurality of elastic pawls **225**_b_ extends radially outwardly from the through-hole **225**_a_. The elastic pawls **225**_b_ engage the pawl receiving portions **235**_c_. In particular, as shown in FIG. **14**, the elastic pawls **225**_b_ of the vibration damper **225** are disposed abutting the pair of side walls **235**_d_ of the pawl receiving portions **235**_c_.

Rotation Transmission Path

The rotation transmission path of the third embodiment has the same configuration as the second embodiment, and follows the same rotation transmission path as that of the second embodiment. Therefore, a detailed description is omitted here.

Other Embodiments

The present invention is not limited to the above-described embodiments, and various modifications and adjustments are possible. Especially, the various embodiments and modified examples described in the present Specification can be freely combined according to necessity.

In the first embodiment, a large-dimension portion **18**_c_ and a small-dimension portion **18**_d_ are formed on the handle shaft **18**, and a vibration damper **25** is attached to the outer periphery of the small-dimension portion **18**_d_; however, the handle shaft **18** can be configured to have a uniform outer dimension, and an elastic member made of rubber or resin may be attached to a groove provided in the outer periphery of the handle shaft **18**.

In the first embodiment, the engagement hole **29**_a_ of the engagement portion **29** is engaged by having an oval shape, but the shape is not limited to an oval shape. The hole may be engaged being having a polygonal shape, a D cut, a key, or a spline. Additionally, regarding the second and third embodiments, as well, the elastic pawls **125**_b_, **225**_b_ and metal pawls **36**_b_, **236**_b_ engage a plurality of pawl receiving portions **35**_c_, **235**_c_, but it suffices to have at least one engagement portion.

In the modified example of the second embodiment, it suffices to provide a vibration damper **125**_c_ at least to a portion where the first metal member **35** engages the second metal member **36**. Further, the vibration damper **125**_c_ may be integrally provided on the first or the second metal member **35**, **36**, covering the first or the second metal member **35**, **36**.

The tubular member in the first embodiment, and the first and second metal members in the second and third embodiments, may be formed by a material other than metal, as long as the rigidity is higher than that of the vibration damper.

The modified example of the second embodiment may also be applied to the third embodiment.

In all of the embodiments, it is preferable that the vibration damper is provided in a transmission path with a smaller diameter than the diameter of the gear in which vibration due to the engagement of gears is generated, which allows a more effective damping of the vibration.

What is claimed is:

1. A gear mechanism for a fishing reel, comprising:

a drive gear having a gear with a prescribed diameter and a drive gear shaft configured to be rotated together with the gear and having a smaller dimension than the prescribed diameter of the gear, the drive gear shaft including a handle shaft, and the handle shaft having a large-dimension portion and a small-dimension portion, the small-dimension portion having a smaller dimension than a dimension of the large-dimension portion; and

a handle configured to rotate with the drive gear shaft, the handle comprising

a handle arm extending in a direction that axially intersects the drive gear shaft,

a first transmitting member non-rotatably coupled to the handle arm and having an engaged portion, the first transmitting member being a tubular member with an inner surface, and configured to rotate with the drive gear shaft; and

a second transmitting member having an engaged portion to which a rotational force is capable of being transmitted from the engaged portion of the first transmitting member,

a vibration damper having an internal surface and being disposed between the drive gear shaft and the first transmitting member of the handle, and configured to dampen transmission of vibration of the drive gear, the vibration damper being formed in an entirely annular shape along an entirety of the internal surface thereof, the entirety of the internal surface of the vibration damper extending around an outer surface of the small-dimension portion of the handle shaft and an outer surface of the vibration damper being disposed along the inner surface of the first transmitting member, and

the vibration damper abutting the engaged portion of the first transmitting member and the engaged portion of the second transmitting member, being configured to transmit the rotation of the first transmitting member to the second transmitting member, and having a lower rigidity than the first and second transmitting members, and capable of being elastically deformed.

2. The gear mechanism for a fishing reel recited in claim **1**, wherein

the first transmitting member has an engagement portion forming a prescribed gap from the drive gear shaft in an inner portion thereof in a rotational direction,

the vibration damper being disposed in at least a portion of the prescribed gap.

3. The gear mechanism for a fishing reel recited in claim **2**,

wherein

the vibration damper engages the engaged portion of the first transmitting member, and is an elastic member with a lower rigidity than that of the first transmitting member.

4. The gear mechanism for a fishing reel recited in claim **3**,

wherein

the engaged portion of the first transmitting member is configured to engage the engaged portion of the second transmitting portion after the vibration damper is elastically deformed by a prescribed amount.

5. The gear mechanism for a fishing reel recited in claim **4**,

wherein

the large-dimension portion and the small-dimension portion are disposed in the inner portion of the first transmitting member, and

the large-dimension portion is configured to engage the engagement portion of the tubular member after the vibration damper has been elastically deformed by a prescribed amount.

6. The gear mechanism for a fishing reel recited in claim **2**,

wherein

the first transmitting member is made of a metal.

7. The gear mechanism for a fishing reel recited in claim **1**, wherein

the vibration damper has a continuous annular inner surface.

* * * * *